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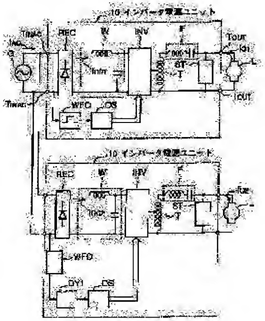
(54) PARALLEL OPERATION METHOD FOR INVERTER, POWER SUPPLY UNIT FOR INVERTER AND INVERTER POWER SUPPLY UNIT FOR LIGHTING DISCHARGE LAMP

(57)Abstract:



PROBLEM TO BE SOLVED: To suppress a high frequency current flowing to the power supply side by driving a plurality of inverter power supply units with different phase and averaging the instantaneous value of currents flowing to the power supply side due to the phase difference.

SOLUTION: A phase setting means sets the driving phase of an inverter INV depending on the number of inverter power supply units 10 connected with a power supply. Consequently, both even number parallel operation and odd number parallel operation can be dealt with practically. The inverter power supply units 10 comprise M inverters INV which are driven with a phase difference of 360°/M or 180°/M from each other. Consequently, an optimal parallel operating state can be configured by simply connecting inverter power supply units 10 with a power supply and then connecting a load. Consequently,

it can be operated practically as an easy-to-handle inverter power supply unit 10 while suppressing high frequency current flowing to the power supply side.

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CLAIMS

[Claim(s)]
[Claim 1] The parallel operation approach of the inverter characterized by equalizing the instantaneous value of the current which supplies power to two or more inverters from a common power source, each inverter is alike, respectively, is made to generate the alternating current power of a frequency more higher than commercial frequency, supplies this alternating current power to a load, respectively, shifts the drive phase of each inverter in the power unit using the inverter which operates each load, and flows to the above-mentioned power source.
[Claim 2] the parallel operation approach of the inverter characterized by making the number of the above-mentioned inverters into a M-N (M being two or more positive integers, and N being one or more positive integers) radical, dividing the inverter of these MN(s) radical into M group in the parallel operation approach of an inverter according to claim 1, giving 360-degree/M or 180 degrees/M [every] phase contrast, and operating the inverter of each group, respectively.
[Claim 3] A. the alternating-current-power receiving end child who receives alternating current power with commercial frequency, and B. -- with the full wave rectifier circuit which rectifies the alternating current power which received transmitted electricity to this alternating-current-power receiving end child C. -- the smoothing circuit which carries out smooth [of the rectification power which rectified in this full wave rectifier circuit], and D. -- with the inverter which changes the direct current power which carried out smooth in this smoothing circuit into the alternating current power of a frequency higher than the alternating current power which received transmitted electricity to the above-mentioned alternating-current-power receiving end child E. With the sending end child for supplying the conversion output of this inverter to a load F. -- a drive signal generation means to supply a driving signal to the above-mentioned inverter, and G. -- the inverter power supply unit characterized by providing and constituting a phase setting means to set the drive phase of this drive signal generation means as a criteria phase or other phases.
[Claim 4] A. the alternating-current-power receiving end child who receives alternating current power with commercial frequency, and B. -- with the full wave rectifier circuit which rectifies the alternating current power which received transmitted electricity to this alternating-current-power receiving end child C. -- the smoothing circuit which carries out smooth [of the rectification power which rectified in this full wave rectifier circuit], and D. -- with the inverter of M radical which changes the direct current power which carried out smooth in this smoothing circuit into the alternating current power of a frequency higher than the alternating current power which received transmitted electricity to the above-mentioned alternating-current-power receiving end child E. With M sets of sending end children for supplying each conversion output of M sets of these inverters to a load F. M sets of drive signal generation means to supply the driving signal which has the phase contrast of 360-degree/M or 180 degrees/M in each of the M above-mentioned sets of inverters, and inverter power supply unit characterized by constituting "Be alike."
[Claim 5] A. the direct-current-power receiving end child who receives direct current power, and B. -- with the inverter which changes into the alternating current power of a frequency higher than

commercial frequency the direct current power by which power receiving is carried out to this direct-current-power receiving end child C. With the sending end child for supplying the alternating current power changed with this inverter to a load D. The smoothing circuit which carries out smooth [of the load current which is inserted between the above-mentioned direct-current-power receiving end child and the above-mentioned inverter, and is supplied to the above-mentioned load], E. -- a drive signal generation means to supply a driving signal to the above-mentioned inverter, and F. -- a phase setting means by which a criteria phase or others carries out a phase setup of the drive phase of this drive signal generation means, and the inverter power supply unit characterized by constituting "be alike."
[Claim 6] A. the direct-current-power receiving end child who receives direct current power, and B. -- with the inverter of M radical which changes into the alternating current power of a frequency higher than commercial frequency the direct current power by which power receiving is carried out to this direct-current-power receiving end child C. With M sets of sending end children for supplying to a load the alternating current power changed by M sets of these inverters D. The smoothing circuit which carries out smooth [of the load current which is inserted between the M above-mentioned sets of inverters, and the above-mentioned direct-current-power receiving end child, and is supplied to each of the above-mentioned load], E. M sets of drive signal generation means to supply the driving signal which has the phase contrast of 360-degree/M or 180 degrees/M in each of the M above-mentioned sets of inverters, and inverter power supply unit characterized by constituting "Be alike."
[Claim 7] The inverter power supply unit for electric-discharge lamp lighting characterized by having set they being [any of an inverter power supply unit according to claim 3 to 6], and adding and constituting the pressure-up transformer, filter, and electric-discharge lamp bootstrap circuit for electric-discharge lamp lighting between the above-mentioned inverter and a sending end child.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the inverter power supply unit and the inverter power supply unit for electric-discharge lamp lighting which use when making many electric-discharge lamps turn on like the fishing light, and are used for the parallel operation approach of a suitable inverter, and this.
[0002]
[Description of the Prior Art] In recent years, in fishing grounds, many metal halide lamps (electric-discharge lamp) with high luminous efficiency are used by high brightness to the incandescent lamp-type fishing light. As shown in drawing 15 , power supply unit UN which makes this electric-discharge lamp turn on With the alternating-current-power receiving end child TINAC Sending end child TOUT who connects the electric-discharge lamp L used as Filter F, and a bootstrap circuit ST and a load It is constituted. [the pressure-up transformer T, and] He is the sending end child TOUT about the alternating current power by which supplied the 60Hz alternating current power which is one of the commercial frequency from Generator G to the pressure-up transformer T, and the pressure up was carried out to it through the alternating-current-power receiving end child TINAC. It is impressed by the electric-discharge lamp L which consists of the connected metal halide lamp, and it is switched on.
[0003] Since the pressure-up transformer T and Filter F are made as an object for 60Hz, this power supply unit UN has a large-sized magnetic core, and has the fault to which weight becomes very heavy. For example, with the cuttlefish fishing boat, the near lamp is installed 100 LGTs and the miniaturization and lightweight-izing of power supply unit UN which are used for the fishing light are strongly desired by such small fishing boat. As shown in drawing 16 as one approach for solving this problem, the power supply unit UNV using Inverter INV is considered. The rectifier circuit REC which rectifies the alternating current power in which this power supply unit UNV has the commercial frequency which received transmitted electricity from the alternating-current-power receiving end child TINAC and this alternating-current-power receiving end child TINAC, The inverter INV which changes into the alternating current power of a frequency higher than commercial frequency the smooth output power of the smoothing circuit W which carries out smooth [of the rectification power which rectified in this rectifier circuit REC], and this smoothing circuit W, The pressure-up transformer T which carries out the pressure up of the electrical potential difference of the alternating current power which this inverter INV outputs The bootstrap circuit ST for starting the electric-discharge lamp L used as the filter F which brings the wave of this power by which the pressure up was carried out close to a sinusoidal form, and a load Sending end child TOUT for supplying the alternating current power generated with Inverter INV in the electric-discharge lamp L used as a load It is constituted by drive signal generation means OS to give a driving signal to Inverter INV.
[0004] Inverter INV carries out parallel connection of the series circuit which carried out series connection of every two insulated-gate mold bipolar transistors (Following IGBT is called) Q1, Q2, Q3, and Q4 as everyone knows. The IGBT which carried out series connection The primary coil of the

pressure-up transformer T is connected during each node of Q1, Q2, and Q3 and Q4, and it is IGBT. It operates so that the condition of making it flowing through Q1 and Q4, and the condition of making it flowing through Q2 and Q3 may be repeated by turns and alternating current power may be impressed to the pressure-up transformer T.

[0005] IGBT will be in the condition of ON, only while impressing the pulse of straight polarity to a gate electrode. Therefore, each IGBT which constitutes Inverter INV The driving signals SG1-SG4 shown in each gate electrodes G1-G4 of Q1-Q4 at drawing 17 are supplied. That is, it is in phase in driving signals SG1 and SG4, and IGBT. The gate electrodes G1 and G4 of Q1 and Q4 are given, and it is IGBT about driving signals SG2 and SG3. It gives the gate electrode G2 and G3 of Q2 and Q3. Frequency f0 of the alternating current power impressed to the electric-discharge lamp L which serves as a load by driving signals SG1 and SG4 and the generating time amount T1 and T2 of SG2 and SG3 It is determined. frequency f0 of the alternating current power to which the frequency of the alternating current power which an alternating current power source (this example the generator G) generates in this example is set to 60Hz, and one 6 times that frequency of 360Hz of this is supplied by the load ** -- the case where it carries out is explained. Between time amount T1 and T2, each driving signals SG1-SG4 generate two or more pulses by which Pulse Density Modulation was carried out, and are constituted. According to a sinusoidal form, Pulse Density Modulation of the Pulse Density Modulation is carried out so that the output current may approach a sine wave and it may become the maximum pulse width in each central part of time amount T1 and T2.

[0006] An example of the drive signal generation means OS is shown in drawing 19 . The drive signal generation means OS is constituted by the address counter ADRC which carries out counting of the number of the clock pulses which were prepared in order to generate a clock pulse with a frequency (this example 60x 6= 360Hz) N times the frequency of the alternating current power which the generator G used as an alternating current power source generates, and which Oscillator OSC and this oscillator OSC generate, for example, and accesses the wave storage machine WFM.

[0007] A read only memory (ROM) can constitute and, as for the wave storage machine WFM, the driving signals SG1-SG4 shown in this wave storage machine WFM at drawing 17 A are memorized in order of the address by one period (T1+T2). A ring counter can constitute an address counter ADRC, and corresponding to the number of the pulses supplied from Oscillator OSC, it repeats the address from the start address of the wave storage machine WFM to the last address, and is generated.

[0008] read-out of the driving signals SG1-SG4 read from the wave storage machine WFM here -- resolution -- the inside of the time amount of T1+T2 -- for example, if it shall read with the resolution of ten division into equal parts, 360x10=3.6kHz and number 1-/of dividing J of a counting-down circuit DV will be set to J= 60 by the oscillation frequency of a voltage controlled oscillator VCO by 3.6 kHz/J=60Hz. The driving signals SG1-SG4 shown in Inverter INV at drawing 17 A are supplied, and when IGBTQ1, Q4, and Q2 and Q3 turn on and carry out OFF actuation by turns, pulse-voltage VP shown in the primary coil of the pressure-up transformer T at drawing 17 B is impressed. The output current IO of the shape of a sine wave shown in a electric-discharge lamp L at drawing 17 C by being impressed by the series circuit where this pulse-voltage VP consists of Filter F and a electric-discharge lamp L It flows. This current IO Frequency f0 It is set to f0 =360Hz decided by synchronous T1+T2 of driving signals SG1-SG4.

[0009] It is IO as the output current of Inverter INV. By flowing, as shown in the input side of Inverter INV at drawing 17 D, it is the output current IO. It is 0 2f in the both sides of the forward half cycle of the alternating current power AC (drawing 18 A) which the pulsating current IDC which carried out full wave rectification flows, and Generator G generates to the input side G of a rectifier circuit REC, i.e., a generator, and a negative half cycle. The current IAC with a frequency (drawing 18 B) flows.

[0010]

[Problem(s) to be Solved by the Invention] When the current IAC of a high frequency as shown in Generator G at drawing 18 B flows, with Generator G, a power-factor declines and un-arranging [for which an effective output capacitance falls] arises. Furthermore, in order to invite local generation of heat to a rotor coil etc., it is necessary to reduce a load factor sharply. That is, there is a fault which must

use a generator with larger power capacity than apparent load-carrying capacity.
[0011] Moreover, even when using a cell as a power source, if the current of a high frequency is taken out from a cell, un-arranging [which shortens the life of a cell] will arise with generation of heat. In order to cancel this fault, using the active filter AF equipped with the active element as shown in drawing 20 is also considered. According to this active filter AF, it has a feedback circuit which makes an input current a sine wave, and the function which controls a higher harmonic is demonstrated.
[0012] However, cost starts equipping this active filter AF, and enlargement of equipment and increase of weight are not avoided. The purpose of this invention tends to offer the parallel operation approach of the inverter which can control the current of the high frequency which flows to a power-source side by the easy approach, and the inverter power supply unit and the inverter power supply unit for electric-discharge lamp lighting used for this, without hanging cost.
[0013]
[Means for Solving the Problem] According to the parallel operation approach of the inverter by this invention, two or more inverter power supply units are prepared, and a phase tends to be changed, and you are going to make two or more of these inverter power supply units drive, and are going to make it operate two or more inverters so that the instantaneous value of the current which flows to a power-source side by the difference in a phase may be equalized.
[0014] By equalizing the instantaneous value of the current which flows to a power-source side, harmonic content can be reduced sharply. When using as a result, for example, a generator, since a power-factor is greatly improvable, the advantage which can make power capacity of a generator small is acquired. Moreover, since the harmonic content contained in the current which flows on a cell can be sharply reduced even when using a cell, generation of heat of a cell can be suppressed and the advantage which can control compaction of a life is acquired.
[0015] When carrying out parallel operation of even sets of the inverters, even sets of these inverters are divided into two, about 90-degree phase contrast is given and parallel operation of the inverter of one group and the inverter of the group of another side is carried out. 2fo(es) which flow to a generator in the situation of this parallel operation Since the group of another side serves as opposition relation it is unrelated to the minimum value when, as for the current of a frequency, one group takes maximum, the instantaneous value of a current is equalized. That is, pulsation (ripple) serves as few current wave forms, and the content of harmonic content can be reduced.
[0016] When carrying out parallel operation of the inverter of the integral multiple radical of 3, the inverter of the base is divided into three groups, a phase is shifted and parallel operation of every about 120 degrees of the inverters of each group is carried out. 2fo(es) which flow to a generator in the situation of this parallel operation Since the current of a frequency has 120 degrees of phase contrast at a time mutually, the advantage which reduces further the ripple of a current which flows a generator and can reduce the content of harmonic content further is acquired.
[0017] They are M.N sets if the base of an inverter is generalized. M can be defined as the number of parallel operation of an inverter, and two or more positive integers and N can be defined as the number of allocation **** inverters at each group of the inverter by which parallel operation is carried out, and can be made into one or more positive integers. What is necessary is to divide M.N sets of inverters into M group, and for the inverter of M group to give the phase contrast of 360-degree/M or 180 degrees/M, and just to make it operate.
[0018] However, although the phase contrast between inverters which divided into two groups in the case of M= 2 becomes only 90 degrees, it can be considered that the case of 120 degrees and the case of 60 degrees mentioned above in the case of M= 3. That is, when a rectifier circuit REC is a full wave rectifier circuit, the phase contrast of the pulsating flow which flows as a result of carrying out full wave rectification also of which, even if it shifts a phase and it operated the inverter divided into three groups every [120], and shifts 60 degrees at a time and made it operate becomes 60 degrees.
[0019] 360 degree/4, 180 degree/4, or any is sufficient as the phase contrast which is given from this at an inverter also in the case of M= 4. Moreover, the number M of parallel operation of an inverter can make small the ripple of a current which flows to a power-source side, so that it can be set as four or

more numbers and takes the number of M greatly. The inverter power supply unit (it corresponds to claims 3 and 5) with the 1st configuration by this invention is characterized by the configuration possessing a drive signal generation means to give a driving signal to one set of an inverter, and this inverter for every unit, and a phase setting means to set the phase of the driving signal which this drive signal generation means generates as a criteria phase (zero phase) or other phases.

[0020] According to the inverter power supply unit with this 1st configuration, since the drive phase of an inverter can be set up with a phase setting means corresponding to the number of the inverter power supply units linked to a power source, an advantage usable corresponding to both even number parallel operation and odd number parallel operation is acquired. The inverter power supply unit (it corresponds to claims 4 and 6) with the 2nd configuration of this invention prepares M sets of inverters in a unit, and is characterized by the point considered as the configuration which gives the phase contrast of 360-degree/M or 180 degrees/M, and drives M sets of these inverters mutually.

[0021] According to the inverter power supply unit with this 2nd configuration, since it is incorporated so that M sets of inverters may give the phase contrast of 360-degree/M or 180 degrees/M mutually and it may operate for every inverter power supply unit, each inverter power supply unit can be connected to a power source, and the situation of the optimal parallel operation can be built only by the activity which connects a load. Therefore, an advantage usable as an inverter power supply unit with easy handling is acquired.

[0022]

[Embodiment of the Invention] The block diagram for explaining to drawing 1 the parallel operation approach of the inverter proposed by claim 1 of this application is shown. This drawing 1 shows the case where it considers as AC generator G as a power source. Moreover, this example shows the example in the case of carrying out parallel operation of the even inverters. That is, the example for explaining the case where the number M of parallel operation of an inverter is set to M= 2 in the inverter parallel operation approach proposed by claim 2 as a concrete example is shown. In this example, it is referred to as M= 2 and N= 1, and the case where two sets of the inverter power supply units 10 are used is shown. These two sets of the inverter power supply units 10 show the case where a electric-discharge lamp L is made to turn on as a load, respectively. For this reason, he is the sending end child TOUT about the bootstrap circuit ST which starts the pressure-up transformer T made to generate an electrical potential difference required for making a electric-discharge lamp L turn on, and a electric-discharge lamp L. The example with which the side was equipped is shown.

[0023] By the parallel operation approach of this invention, parallel operation is carried out so that two sets of the inverter power supply units 10 may give phase contrast (about 180 degrees/M= 90 degrees) mutually and it may operate. The synchronizing signal shaped in waveform and obtained with one inverter power supply unit 10 as a configuration for this in the waveform shaping circuit WFO is inputted into the direct-drive signal generation means OS. As opposed to making Inverter INV drive with the criteria phase which synchronized with the alternating-voltage signal which Generator G generates In the inverter power supply unit 10 of another side, it is characterized by the point considered as the configuration which inputs into the drive signal generation means OS the synchronizing signal shaped in waveform and obtained through the delay circuit DY1 delayed by the phase of about 90 degrees (or 270 degrees). By the configuration which formed this delay circuit DY1, about 90-degree phase contrast can be given and two sets of the inverter power supply units 10 can be operated.

[0024] By driving with the phase contrast two sets of whose inverters INV are about 90 degrees, as shown in the electric-discharge lamp L used as a load at drawing 2 A, the currents I01 and I02 from which about 90 degrees of phases differ mutually flow. These currents I01 and I02 can set to 360Hz the metaphor decided by periodic T1+T2 of the driving signals SG1-SG4 generated with the drive signal generation means OS as drawing 17 explained.

[0025] When the alternating current I01 and I02 from which about 90 degrees of phases differ for a load flowed, the rectified currents IB1 and IB2 shown in drawing 2 B flow to the output side W of a rectifier circuit REC, i.e., a smoothing circuit. As for these rectified currents IB1 and IB2, when one side is maximum, another side has the relation of an opposite phase it is unrelated to the minimum value.

Therefore, the part of a trough is buried and graduated mutually and the synthetic current which flows to the common generator G turns into a current with the amount of small ripple. The wave of the alternating current IAC taken out from Generator G by drawing 3 is shown. Ripple RP becomes a part for the ripple which compounded the rectified currents IB1 and IB2 shown in drawing 2 B.
[0026] According to the wave of alternating current IAC shown in drawing 3 , as compared with the case of the alternating current IAC shown in drawing 18 , harmonic content is reduced sharply. That is, the 60Hz component of a fundamental wave serves as level with harmonic content smaller than a fundamental wave at the maximum. Therefore, the bad influence to the generator G by the higher harmonic is reduced. Although **** explained the case where it was referred to as M= 2 and N= 1, if even inverters are divided into two groups when referred to as N> 1, it can understand the number easily that there is no limit within the limits of the capacity of Generator G.
[0027] Drawing 4 shows the block diagram for explaining the case where the number M of parallel operation of Inverter INV is set to M= 3 and N= 1 in the parallel operation approach of the inverter proposed by claim 2 of this invention. Therefore, in the example shown in drawing 4 , three sets of the inverter power supply units 10 are prepared, and the case where shift a phase and it operates these three sets of about 120 degrees of inverter power supply units 10 at a time is shown.
[0028] For this reason, the 1st set of the inverter power supply unit 10 inputs a direct synchronizing signal into the source OS of a driving signal from a waveform shaping circuit WFO. Make it operate with the criteria phase which synchronized with the alternating voltage which AC generator G generates, and the synchronizing signal outputted from a waveform shaping circuit WFO by the 2nd set of the inverter power supply units 10 is given to the drive signal generation means OS through the delay circuit DY2 delayed by 120 degrees. From the 3rd set of the inverter power supply units 10, it constitutes so that the square wave outputted from a waveform shaping circuit WFO may be given to the drive signal generation means OS through the delay circuit DY3 delayed by 240 degrees. time delay tau 2 for carrying out 120-degree late phase the case where the frequency of the output current of Inverter INV is 360Hz -- tau2 =(1/360Hz) (120-degree / 360 degrees) ** -- time delay tau 3 of the delay circuit DY3 delayed 240 degrees for 0.926ms tau3 =(1/360Hz) (240-degree / 360 degrees) **1.00ms comes.
[0029] Thus, by shifting a phase and operating three sets of 120 degrees of inverters at a time, the currents I01, I02, and I03 shown in each electric-discharge lamp L at drawing 5 A flow. These currents I01-I03 turn into three-phase alternating current which has 120-degree phase contrast, respectively. They are the rectified currents [IDC / IDC, IDC /2 /, and / 3] 1 which show each currents I01, I02, and I03 to drawing 5 B by the input side of each smoothing circuit W. It flows by carrying out. This rectified current IDC 1 IDC2 And IDC3 Since it is compounded by AC generator G and flows, the current IAC shown in drawing 6 is taken out from AC generator G. This current IAC is the rectified current IDC 1 of a three phase circuit - IDC3. Since it is the compound current, Ripple RP becomes small from the alternating current IAC shown in drawing 3 . Therefore, harmonic content contained in addition to a fundamental wave can be made still fewer than the case of drawing 3 , and the advantage which can mitigate the bad influence to Generator G is acquired. In addition, although **** explained the case where AC generator G was used as a power source, the inverter parallel operation approach by this invention can be similarly applied, when a power source is a direct current. Since the amount of the harmonic content contained in the current similarly taken out from a cell is reduced also when a power source is a direct current (when it is a cell), the advantage which can make the bad influence to a cell small is acquired. In addition, currents [IDC / IDC, IDC /2 /, and / 3] 1 by which full wave rectification was carried out here so that clearly from drawing 5 B Phase contrast becomes 60 degrees. Therefore, even if it operates three sets of Inverters INV by 60-degree phase contrast, the same result as the case of 120-degree phase contrast is obtained.
[0030] Drawing 7 shows the example of the inverter power supply unit proposed by claim 3 of this application. This example shows the case where a power source is AC generator G. Therefore, the inverter power supply unit 10 possesses the alternating current receiving end child TINAC and a full wave rectifier circuit REC, rectifies alternating current power, once changes it into direct current power, and is considered as the configuration which impresses the direct current power to Inverter INV through

a smoothing circuit W.
[0031] The inverter power supply unit 10 proposed by this claim 3 is considered as the configuration in which Inverter INV can respond to all of odd sets of even sets of parallel operation, and parallel operation. That is, it is characterized by the configuration possessing the 1st delay circuit DY1 with the amount of delay of 90-degree considerable amount other than a waveform shaping circuit WFO, the 2nd delay circuit DY2 with the amount of delay of 120-degree considerable amount, the 3rd delay circuit DY3 with the amount of delay of 240-degree considerable amount, and a phase setting means 11 to choose each of these delay outputs or the output of a waveform shaping circuit WFO, and to set up the drive phase of Inverter INV.
[0032] Thus, corresponding to the number of the inverter power supply units 10 connected to Generator G, each inverter power supply unit can be freely set up as an inverter power supply unit which operates with which phase by considering as the configuration which chooses a synchronizing signal with each amount of delay as the drive signal generation means OS, and can supply it. That is, what is necessary is to divide even sets of the inverter power supply units 10 into two groups, to set the phase setting means 11 of the inverter power supply unit of one group as the change location 1, and just to ** the phase setting means 11 of the inverter power supply unit of the group of another side in the change location 2, when operating the inverter power supply unit 10 by even sets.
[0033] Moreover, when making it operate by the number of the integral multiples of 3, the inverter power supply unit 10 of the number is divided into three groups. The phase setting means 11 of the inverter power supply unit 10 of the one group is set as the change location 1. If the phase setting means 11 of the inverter power supply unit 10 of other one group is set as the change location 3 and the phase setting means 11 of the inverter power supply unit 10 of one group of further others is set as the change location 4 The inverter of each group can operate with every 120 degrees phase contrast mutually, and can build the optimal parallel operation situation.
[0034] In addition, although drawing 7 showed the case where phase contrast which can be set up was made into 90 degrees, 120 degrees, and 240 degrees When the number M of parallel operation of Inverter INV is M= 3, 360 degree/3,180 degree/3, the case of M= 4 -- 360 degree/4,180 degree/4, and the case of M= 5 -- 360 degree/5,180 degree/5, and the case of M= 6 -- 6,180 degrees [360 degrees /]/6 ... like -- several [of each parallel operation] -- it can also constitute so that a delay circuit with the amount of delay corresponding to the value of M may be prepared.
[0035] Drawing 8 shows the example at the time of setting the number M of parallel operation of an inverter to M= 2 in the inverter power supply unit proposed by claim 4 of this application. Since the inverter power supply unit 10 proposed by this claim 4 possessed the alternating-current-power receiving end child TINAC and the full wave rectifier circuit REC like the example of drawing 7 and also was set to M= 2, it equips two sets of Inverters INV in a common case (inside of a unit), and the case where two sets of these inverters INV are mutually constituted so that 90-degree phase contrast may be given and it may be made to operate is shown.
[0036] Two sets of Inverters INV show the case where it constitutes from this example so that it may drive with the synchronizing signal outputted from the common oscillator OSC. That is, one inverter INV receives the synchronizing signal outputted from Oscillator OSC with the direct address counter ADRC, generates an address signal with a criteria phase, generates the driving signal which gives this address signal to the wave storage machine WFM, and has a criteria phase, and is driven.
[0037] The inverter of another side delays the synchronizing signal generated with Oscillator OSC in the delay circuit DY1 which gives 90-degree phase contrast, is given to an address counter ADRC, gives the address signal generated with this address counter ADRC to the wave storage machine WFM, generates a driving signal, and is driven with this driving signal. The synchronizing signal which serves as a criteria phase from a waveform shaping circuit WFO is given to one side of the drive signal generation means OS which for that drives two sets of Inverters INV, and it considers as the configuration which gives a synchronizing signal through the delay circuit DY1 which has the time delay of 90-degree considerable amount for the synchronizing signal outputted from a waveform shaping circuit WFO in the drive signal generation means OS of another side.

[0038] Thus, by operating two sets of Inverters INV with 90-degree phase contrast inside each inverter power supply unit 10, the current which flows to Generator G is equalized and is made into a current with few contents of a higher harmonic. Therefore, according to the inverter power supply unit 10 proposed by this claim 4, regardless of the number of the inverter power supply units linked to Generator G, the optimal parallel operation condition can be built only by connecting the inverter power supply unit 10 to Generator G.
[0039] Drawing 9 shows the example at the time of being referred to as M= 3 in the inverter power supply unit proposed by claim 4 of this application. In this example, since the inverter power supply unit 10 possessed the alternating-current-power receiving end child TINAC and the full wave rectifier circuit REC like the example shown in drawing 7 and drawing 8 and also was set to M= 3, it equips three sets of Inverters INV in a common case, and the case where three sets of these inverters INV are constituted so that it may shift 120 degrees of phases at a time for each and may be made to operate is shown.
[0040] For this reason, the synchronizing signal which has a criteria phase in the address counter ADRC of the wave storage machine WFM which gives a driving signal to the 1st set of Inverter INV from Oscillator OSC is given, and it supplies through the delay circuit DY2 which has the time delay of 120-degree considerable amount for the synchronizing signal outputted from Oscillator OSC to the 2nd set of Inverters INV, and it constitutes so that a synchronizing signal may be given through the delay circuit DY3 which has the time delay of 240-degree considerable amount in the 3rd set of Inverters INV.
[0041] Thus, by constituting, instantaneous value is equalized, the current wave form where it flows from Generator G to this inverter power supply unit 10 turns into a wave with few higher harmonic waves, as drawing 5 and drawing 6 explained, and the optimal parallel operation situation can be built only by connecting the inverter power supply unit 10 of the number only connectable within the limits of the capacity of Generator G to Generator G.
[0042] Below drawing 10 shows the example of the inverter power supply unit of a direct-current power receiving mold. The example shown in drawing 10 shows the example of the inverter power supply unit proposed by claim 5 of this application. In the inverter power supply unit of a direct-current power receiving mold, the direct-current receiving end child TINDC is provided, the direct smoothing circuit W is connected to this direct-current receiving end child TINDC, and a rectifier circuit REC is omitted.
[0043] A point which the inverter power supply unit 10 of the direct-current power receiving mold shown in drawing 10 is equivalent to the inverter power supply unit of the alternating current power receiving mold shown in drawing 7 , and is greatly different from the example of drawing 7 is a point of having formed the synchronizing signal output terminal TSY which sends out outside the synchronizing signal outputted from a synchronizing signal generator PG and this synchronizing signal generator PG as a source of a synchronizing signal. Drawing 10 shows the configuration of two sets of inverter power supply units for the sake of the convenience explaining the relation between units. As a phase setting means, the changeover switches 11A and 11B of 2 reams are used, and when operating self with a criteria phase, changeover switches 11A and 11B are set as the change location 1. Drawing 10 shows the condition of having set up the inverter power supply unit 10 shown in the bottom as a unit which operates with a criteria phase, and having set the inverter power supply unit shown in the bottom as the unit which operates with 90-degree late phase. Although the synchronizing signal generator PG is formed in each inverter power supply unit 10 at each, when making it operate in a pair, one inverter power supply unit 10 is set up so that it may operate in response to supply of a synchronizing signal from the inverter power supply unit 10 of another side. This setup is set up by circuit changing switch 11B. If circuit changing switch 11B is set as the change location 1, it will be set as the mode in which a synchronizing signal is sent out to other inverter power supply units. It is set as the mode which supplies the synchronizing signal sent from other units in the change location 2 to the drive signal generation means OS through the delay circuit DY1 with the amount of delay of 90 degrees. The mode in which the synchronizing signal sent from other units in the change location 3 is given to the drive signal generation means OS of self through the delay circuit DY2 with the amount of delay of 120 degrees, In the change location 4, it is set as the mode in which the synchronizing signal sent from other units is given to the drive signal generation means OS of self through the delay circuit DY3 with the amount of delay of 240

degrees, respectively. In addition, BF who shows drawing 10 shows the buffer amplifier formed in order to send out a synchronizing signal to other units from a synchronizing signal generator PG.
[0044] One inverter power supply unit 10 like the example of illustration to a criteria phase When it sets up so that it may be made to operate as a unit which carries out 90-degree late phase actuation of the inverter power supply unit 10 of another side Pulsating flow IDC 1 shown in the input side of one unit at drawing 11 A It flows. Pulsating flow IDC 2 shown in the input side of the unit of another side at drawing 11 B Since it flows and the current of the sum flows to the direct-current power source E, the current of the sum serves as a wave by which each instantaneous value was equalized, as shown in drawing 11 C, and serves as a current wave form with few contents of a higher harmonic.
[0045] According to the inverter power supply unit of the direct-current power receiving mold shown in this drawing 10 , since each of the 90-degree delay circuit DY1, the 120-degree delay circuit DY2, and the 240-degree delay circuit DY3 was prepared in each unit in addition to this with the source PG of a synchronizing signal, even parallel operation or odd parallel operation can also be made to be able to respond to all, and can be set up. Therefore, the advantage which can offer the high inverter power supply unit of versatility is acquired. in addition -- this example -- the time delay of a delay circuit -- the base of parallel operation -- it corresponds to M -- making -- the case of M= 3 -- 360 degree/3,180 degree/3, and the case of M= 4 -- the case of 4,180 degrees [360 degrees /]/4 and M= 5 -- the case of 5,180 degrees [360 degrees /]/5 and M= 6 -- 6,180 degrees [360 degrees /]/6 -- it can also constitute so that the delay circuit which has many time delays like ... may be prepared.
[0046] Drawing 12 shows the example at the time of being referred to as M= 2 in the inverter power supply unit proposed by claim 6 of this application. In the inverter power supply unit of a direct-current power receiving mold with the direct-current-power receiving end child TINDC, since the inverter power supply unit 10 proposed by this claim 6 was set to M= 2, it carries two sets of Inverters INV in the same case, and it shows the case where it constitutes so that phase reference may be given and two sets of about 90 degrees of these inverters INV may be operated mutually.
[0047] That is, the synchronizing signal which has a criteria phase in a drive signal generation means OS to give a driving signal into the same case at one inverter INV, from the source PG of a synchronizing signal is given, and a synchronizing signal is given to the drive signal generation means OS for Inverters INV of another side through the delay circuit DY1 with the amount of 90-degree delay. Therefore, according to the inverter power supply unit proposed by this claim 6, since two sets of about 90 degrees of inverters carried only by connecting this unit to the direct-current power source E operate with phase reference mutually, to the direct-current power source E, few [for a ripple] currents (there are few contents of a higher harmonic) flow. Therefore, the cell used as the direct-current power source E etc. is not degraded, and the optimal parallel operation situation can be built.
[0048] Drawing 13 shows the example at the time of being referred to as M= 3 in the inverter power supply unit proposed by claim 6 of this application. Since the inverter power supply unit shown in this example was set to M= 3, it carries three sets of inverters in a common case, and it shows the case where the inverter power supply unit which a phase is shifted [power supply unit] and operates 120 degrees of each of this inverter at a time is constituted.
[0049] The synchronizing signal which follows, for example, is outputted to the drive signal generation means OS of the 1st inverter INV from a synchronizing signal generator PG is given as it is, and a synchronizing signal is given to other one drive signal generation means OS through the delay circuit DY3 which has the amount of late phases of 240 degrees for a synchronizing signal in ** and other one drive signal generation means OS through the delay circuit DY2 with the amount of 120-degree late phases.
[0050] Therefore, three sets of Inverters INV operate also in this example with the phase which differ 120 degrees at a time within the same case. Therefore, it is the current IDC 3 shown in drawing 11 since a direct current adding the current which flows to three sets of these inverters INV became what averaged the three-phase-circuit current. Since the thing which serve as few [for a ripple] currents and serves as the direct-current power source E and which the signal of a higher harmonic or a high frequency flows, for example on a cell is mitigable, the advantage which can avoid un-arranging [which

degrades a direct-current power source] is acquired.
[0051] In addition, although the inverter power supply unit of the direct-current power receiving mold shown in the inverter power supply unit and drawing 13 of the alternating current power receiving mold shown in drawing 9 explained the example which carried three inverters INV in the interior, in this invention, not only three sets but further many inverters shall be carried in a common case, and the configuration which makes it shift and operate shall also be included [a phase] for these inverters in a generic claim, respectively.
[0052] The deformation example of the drive signal generation means OS and the phase setting means 11 is shown in drawing 14 . The wave-like storage region A which has a criteria phase in the wave storage means WFM in this example The wave-like storage region B with the late phase phase of 90 degrees, and the wave-like storage region C with the late phase phase of 120 degrees Form the wave-like storage region D with the late phase phase of 240 degrees, and each [these] storage region A-D is changed with the bank-switching switches SW1-SW4 used as the phase setting means 11. The case where it constitutes so that the phase of the driving signal which sets up which storage region is read and is supplied to an inverter may be set up is shown.
[0053] When taking this configuration, in the case of an alternating current power receiving mold inverter, in the case of a direct-current power receiving mold, the synchronizing signal of the same phase should just be given to the phase-locked loop PLL which constitutes each drive signal generation means OS from a common synchronizing signal generator that what is necessary is just to give the synchronizing signal of the same phase which shaped in waveform from the alternating-voltage wave of an AC generator. Moreover, the configuration which generates the driving signal which has a Gentlemen phase, using a microcomputer as other configurations of a drive signal generation means is also considered.
[0054] Moreover, the inverter power supply unit charged by claim 3 thru/or 6 although the above-mentioned example showed the inverter power supply unit for electric-discharge lamp lighting which equipped all with the pressure-up transformer T, Filter F, and the bootstrap circuit ST is the sending end child TOUT as it is about the output of Inverter INV. The inverter power supply unit of the format to output shall be taken into consideration, and the inverter power supply unit for electric-discharge lamp lighting shall be charged by claim 7.
[0055]
[Effect of the Invention] Since it can prevent that the current of the high frequency generated with an inverter in a power source flows in the power unit which operates many inverters to coincidence by the easy configuration (only combine the inverter with which phases differ) according to this invention as explained above, the fault of an inverter power supply unit can be canceled without hanging cost.
[0056] Moreover, since the power-factor of the current which flows to a generator can be improved as compared with the case of the conventional inverter power supply unit when a power source is an AC generator, the effective capacity of a generator is reduced, also with the generator of small capacity, a load can fully be driven now and a generator can be lightweight-ized. Therefore, it uses for the power unit especially carried in the mobile of the object for small vessels, or others, and the effectiveness is size.

[Translation done.]

DRAWINGS

[Drawing 1]

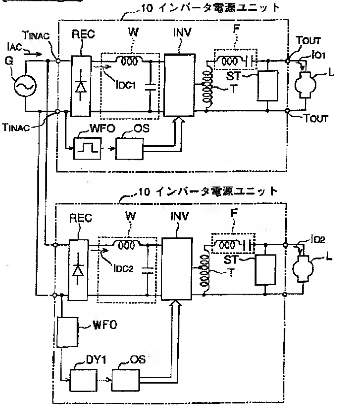
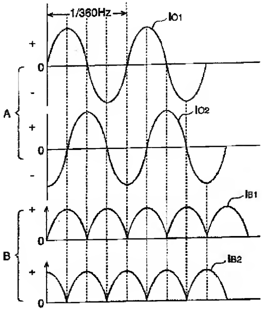


図 1

[Drawing 2]



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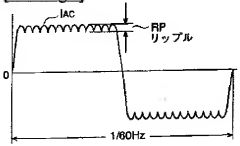
[Drawing 3]



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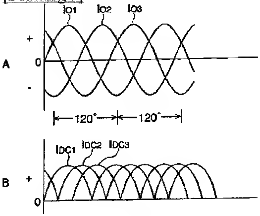
[Drawing 5]



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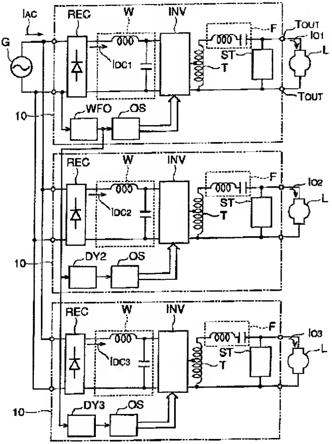
[Drawing 4]



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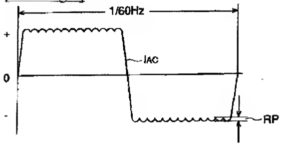
[Drawing 6]



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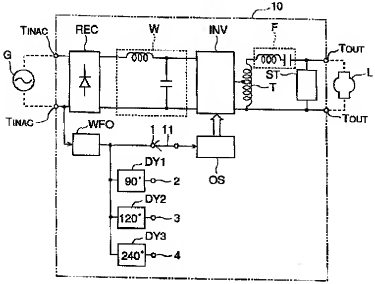
[Drawing 7]



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[Drawing 11]

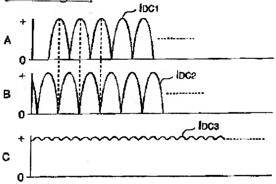
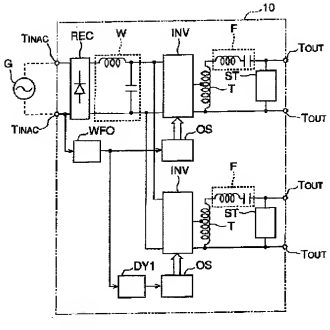


図 11

[Drawing 8]



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[Drawing 9]

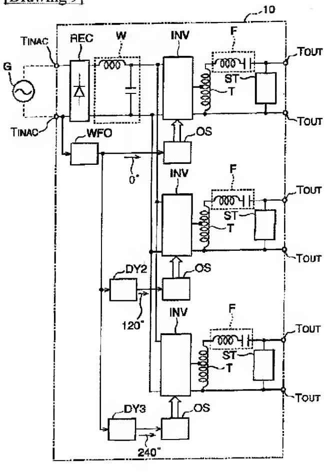

図 9

[Drawing 12]

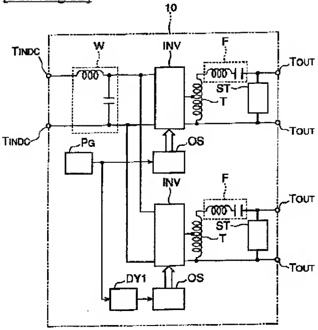

図 12

[Drawing 18]

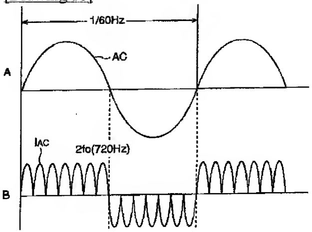

図 18

[Drawing 10]

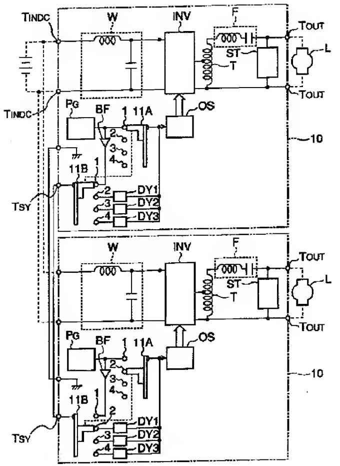

図 10

[Drawing 13]

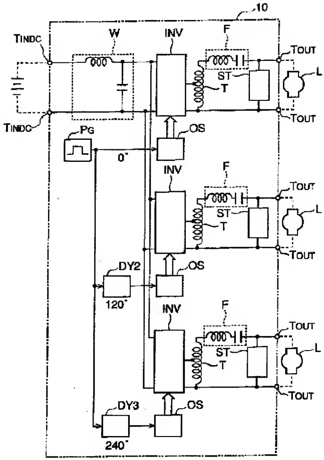

図 13

[Drawing 15]

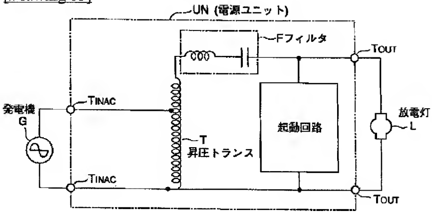

図 15

[Drawing 14]

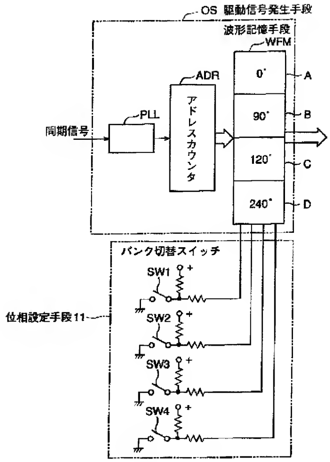

図 14

[Drawing 16]

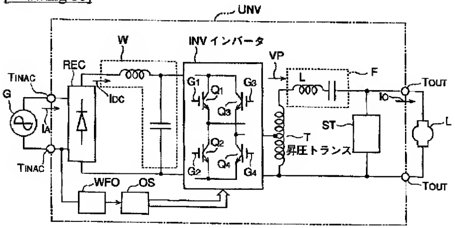

図 16

[Drawing 17]

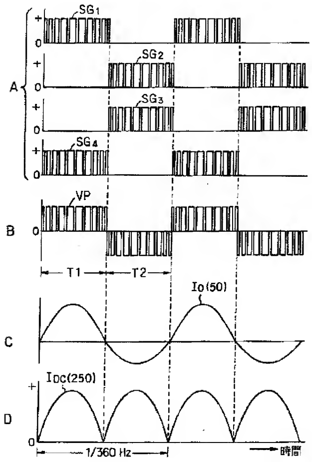

図17

[Drawing 19]

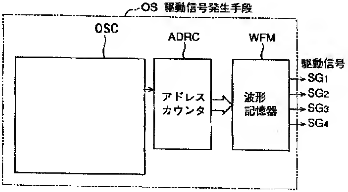

図 19

[Drawing 20]

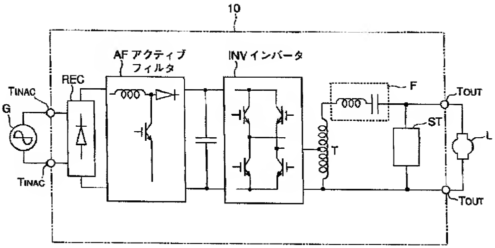

図 20

[Translation done.]